Aspects of Neolithic Agriculture and Shifting Cultivation, Garo Hills, Meghalaya

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ABSTRACT

THE TRADITIONAL SHIFTING cultivation (or slash and burn) being practiced in the Garo Hills has a prehistoric base. The hoe and axe continue as the principal tools, operated exclusively by human energy. We cannot say whether the people of the culture under study are the descendants of the neolithic population, but analogy between the material cultures of the past and present should not be ignored. Chronologically the culture under study is modern, but economically neolithic.

There are differences in the raw material of the tools. Formerly they were made of stone, at present they are iron. Such a difference does not result in a major variation in the quantity of production between past and present. The hoe and axe have inherent limitations in working capability. Such a technology, under the given ecological conditions, can support only 4 to 5 persons per square kilometer. Under the traditional agricultural system, intensification contributes little to improvement, as was the case during neolithic times as well.

INTRODUCTION

The discovery of neolithic artifacts from Garo Hills, Meghalaya (previously Assam) dates back more than a decade now. The work done so far has been primarily confined to the typological and technological aspects of these materials (Goswami and Bhagabati 1959*a*; 1959*b*; Goswami et al. 1969; Sharma and Sharma 1968; Sharma and Singh 1968;

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Sharma 1966; 1967). Functional aspects of these artifacts were merely touched upon. Less emphasis was given to the economy of the people who used the artifacts. The materials covered in this study are from Rengigiri, a site in the central Garo Hills, within the area where the prehistoric artifacts were collected. Typologically these materials are like those studied previously. For the present study 339 complete and utilized tools have been examined, and their length, breadth, thickness, and edge wear patterns recorded. The main focus of this study is the adzes (hoe blades), which constitute the major portion of the collection. I attempt to work out the functional relationship of the adzes to agricultural activities during the neolithic past, and what they suggest about the economic structure of the population living during that period.

Artifacts, whenever and wherever they occur, need to be viewed against their ecological and economic background. An artifact should be understood as a result or product of the interaction between culture and environment. A tool cannot be isolated from either its culture or its economy.

The group of artifacts we are dealing with are assumed to have been used as agricultural tools. I attempt to understand how efficient these artifacts were in carrying out agricultural activities during neolithic times, and to reach a crude approximation of the reality by using ethnographic data from the same area where the tools were collected.

Geography and Geomorphology

This district of Meghalaya is situated between latitudes 25°9′ and 26°0′ North and longitudes 89°9′ and 91°2′ East. The total area of this district is 8080 km² with a population density of 30 to 50 persons per km² according to the 1961 and 1971 census report of India, respectively (Pakyntein 1961). The density of population is greater in and around the urban centers and in the plain bordering Assam. Our observation is that in the interior, in a circle of 5–6 km², there are five or six families, each consisting of 6 to 10 persons.

The Garo Hills border Bangladesh on the south and west, Assam on the north, and Khasi and Jaintin Hill district on the east. They form a part of the central Assam hill range extending from the Mikir Hills in the east to the Garo Hills in the west. In addition to some irregular hillocks, there are two distinct hill ranges: the Tura range (50 km long) extending from Siju in the southeast; and the Arbella range with a less extensive area, situated north of the Tura range. The district has some plains area bordering on Assam and Bangladesh (Borah and Goswami 1977:22). The slopes of the hills where *jhum* cultivation is practiced I estimate to vary from 40 to 60 degrees.

The area is in the subtropical climatic zone, and experiences a moderately heavy annual rainfall (Table 1) which is suitable for the luxuriant growth of deciduous forest that forms a heavy cover over the hilly surface. When the climate and vegetational patterns of this area are compared with those of neighboring areas (Maps 1, 2), a distinct homogeneity between this area and neighboring Southeast Asian countries can be seen. Topographical, climatic, and vegetational similarities between the two areas are often mentioned in relation to the similar cultural patterns and techno-economic development (Roy 1977*a*, 1977*b*). The area is more akin to Southeast Asian highland than to the rest of India.

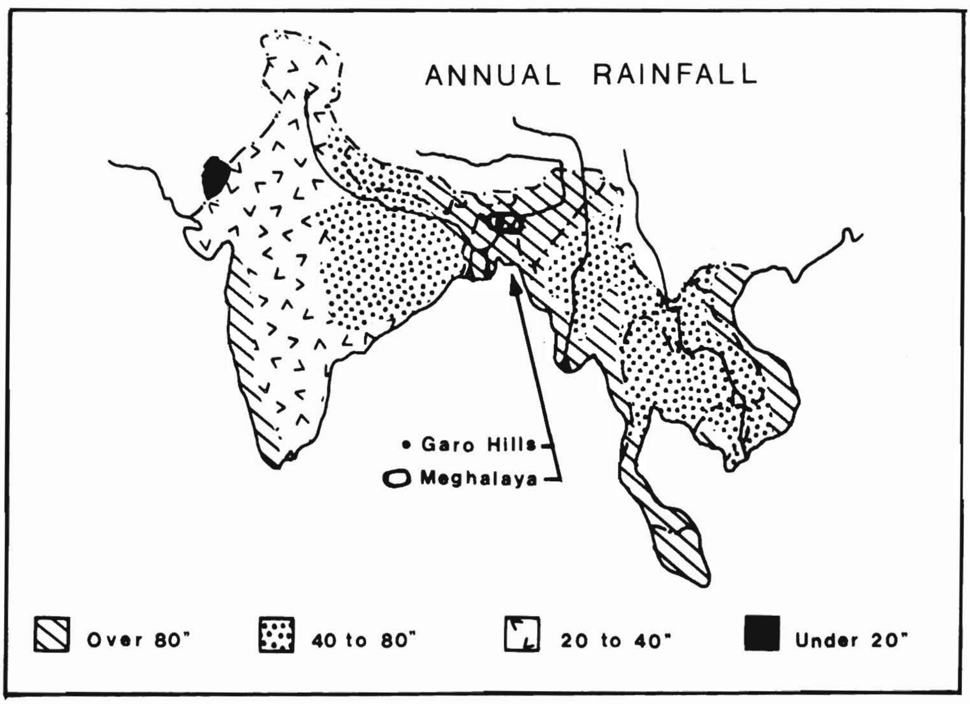
Here organic materials such as leaves grow quickly and decompose at a similar rate. In general it takes 100–400 years to form 1 cm of soil (Swaminathan 1976:3). Under arid climatic conditions the rate of soil formation is slower than in tropical or subtropical areas. The existing cropping pattern is such that heavy rainfall during a year will wash down several centimeters of topsoil, sometimes exposing the bedrock.

TABLE 1. RAINFALL AT TURA (MM)

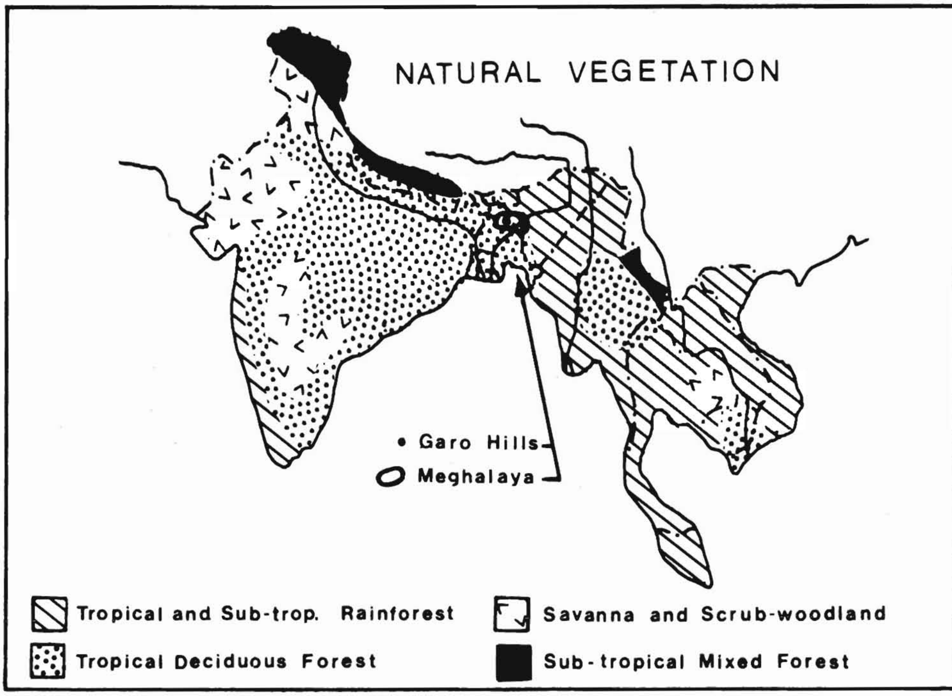
MONTHS	1971	1972	1973	1974	1975	1976
January	11.2	5.3	11.2	0.0	0.0	2.4
February	-	40.4	4.3	0.0	4.4	24.4
March	-	77.2	142.4	0.0	6.0	3.5
April	511.5	225.4	687.1	280.5	225.0	128.7
May	559.2	288.7	1132.6	681.1	801.9	279.7
June	667.4	639.2	627.3	455.2	235.7	712.9
July	457.1	527.0	463.5	1292.0	746.6	432.9
August	356.6	368.7	612.1	659.0	238.2	945.6
September	292.9	373.2	152.0	778.7	391.7	215.1
October	293.6	218.9	81.2	226.5	89.2	188.0
November	54.0	2.8	51.0	0.0	0.0	0.0
December	0.4	0.0	0.0	0.0	0.0	0.0
Total	3203.9	2766.8	3964.7	4373.0	3019.2	2933.2

SOURCE: District Statistical Abstract, Garo Hills, 1974; Office of the Civil Surgeon, Tura.

NOTE: Data from Tura may be made to stand for the three villages as these are around Tura and as there are no data available for the villages themselves.



Map 1 Annual rainfall. (Modified from Cressey 1944 and Cohen 1971 by J. R. McNeill.)



Map 2 Natural vegetation. (Modified from Cressey 1944 and Cohen 1971 by J. R. McNeill.)

Ethnographic Situation in the Garo Hills

It has not been ascertained whether the Garo population inhabiting this area from early times was the forerunner of the present shifting cultivators. This is a problem which needs careful study. The present technology of shifting cultivation does not appear to be much different from that of the earlier neolithic culture, given the similarity between the metallic hoe blades used in the *jhum* operation today and the stone hoes of the past. The archaeological evidence from the Garo Hills (Sharma and Roy 1980; Lal 1969:8), with the homogeneity in size and shape of the earlier lithic with the later iron tools, is suggestive (Goswami 1972).

Nothing is definitely known about the origin of the people living here except some legends, which all say that they migrated from Tibet. There is no archaeological or historical evidence to confirm this. Linguistically, this Mongoloid population is related to other speakers of the Bodo group of the Tibeto-Burman family distributed all over Assam (Playfair 1909:2; Majumdar 1978:17).

Folklore among the Garo has it that in olden days people cleared shifting plots but did not produce cereals. They grew yams and other such root crops. The god of wind in collaboration with the god of hail and storm shook off seeds from the celestial tree. These seeds were picked up and sown by the ancestress of a bird known as *do' amik*. From her the supreme god of the celestial region obtained the seeds of rice and planted them in his own field. Pitying the human beings living in those days without grain, he gave them the seeds, with the instruction that at the beginning of every harvest a portion of the first harvest must be kept aside for him. Another folktale is more specific. According to it the first man to carry on shifting cultivation in the Garo Hills was named Bone-Neripa-Jane-Nitepa. He harvested six big baskets of paddy and six similar baskets of millet from around a rock named *misi-Kokdok.* He was the man who named the different months of the year, each of which is associated with a stage of shifting cultivation (Majumdar 1978:53).

The point that I would like to make from the folklore as recorded by Majumdar (1978) is that rice was a later introduction in this area. It might have been introduced during the historic period or during the neolithic period. There is reason to believe that the varieties cultivated in plough, field, or wet cultivation differ to a great extent from the varieties meant for shifting cultivation. The rice domesticated in Southeast Asia has innumerable generic varieties that are suited to each different environment (e.g., highland). In north-eastern India the traditional shifting cultivators mostly cling to the traditional variety of rice. Some of the newly introduced varieties have been accepted by the shifting cultivators, but with a negative attitude. There is still a question whether the cultivation of rice came down from the hills to the plains or followed the reverse direction.

First, it must be admitted that this agricultural system depends very closely on nature. In order to tide over rainfall uncertainty, dry crops are sown along with wet crops (see Tables 2–5). This was designated as a "naive model of stone age economics" by Suckling (1976:105–115). The character of the cropping pattern reflects the erratic nature of the monsoon climate.

THE LABOR OF *JHUM* FARMING

The felling of trees and lopping of bushes is done during the dry months (December to January), and the materials are left to dry for several months. The main tools used for these purposes are the axe *(rua), ate mongreng,* and chopper *(ate).* The big trees are not all cut down; most of them are left. Only the branches are lopped off, if they are within the reach of the operator.

Fire is set to the felled trees when they have become sufficiently dry. The firing must be done before the onset of rains (Borah and Goswami 1977:27). Farmers' predictions of the arrival of the monsoon rains seldom fail. From clearing to setting fire to the trees are exclusively male activities. The next stage of the operation consists of sowing, weeding, and harvesting, which are the responsibility of the females. Although less strenuous, this stage calls for the involvement of the females for a longer period. The main tool for weeding is the hoe, and for sowing is the digging stick. In some cases the seeds are broadcast on the ash left after burning. The varieties of crops raised and the time taken from sowing to reaping are shown in Table 6. Because the hoe serves as the principal tool for weeding, its place in the *jhum* operation is of prime importance, as is the axe.

THE ARTIFACTS OF *JHUM* FARMING

The observed similarity of edge wear between the stone and iron hoe blades and their occurrence and use on the same surface (hill slope) are significant. It is apparent that tools made of two different materials are discharging similar functions. To understand the functional character of the stone hoe blades under study, the present manipulation and edge-wear patterns of the iron ones were studied. At the same time, other agricultural tools were described briefly.

TABLE 2. CROPS GROWN AT MATCHAKHOLGIRI

LOCAL NAME	ENGLISH NAME	BOTANICAL NAME	VARIETIES (E = EARLY)	REMARKS
mi	paddy	*Oryza sativa*	mima mikotchu malbok padrap mikidip misokmil mirimit misarang (E) midokru mimagisim mimitim gitchak	This variety is meant for *a'breng* only Used for preparation of beer only
mi	paddy	*Oryza sativa*	mimitim doka mimitim dokang mimikdelong aginchi (E) chambak mijenggin sankira	Used for preparation of beer only
misi	finger millet	*Eleusine corakana*	sarang (E) ribok (E) ato (E) redimgisim jongsu binni	 Used for brewing only
mekop	maize	*Zea mays*	akinte (E) bolma babret arai bador	 Used for popcorn
kosta (goru)	Deccan hemp	*Hibiscus cannabinunus*	gitchak gipbok	Grown as a cash crop Grown as a cash crop
tabolchu	manioc	*Manikot utilisimma*	kanem belat	 Recently introduced
te'e	melon	*Cucumis melo*	te'raja te'sosra te'walsri te'gisim	
akaru kobok	white gourd	*Benincasa cerifera*		
gominda	red gourd	*Cucurbita maxima*		
jallik	chilli	*Capsicum annum*		
baring	brinjal	*Solanam* sp.		
rau	gourd	*Lugenaria vulgaris*	chringa dokra bek pong	Used for making receptacles Used for making receptacles Used for making receptacles Used for making receptacles

TABLE 2.—*Continued*

LOCAL NAME	ENGLISH NAME	BOTANICAL NAME	VARIETIES (E = EARLY)	REMARKS
ta'a	arum	*Colocasia antiguorum*	ta'ma	
			ta'ring	
			ringdubi-sarang (E)	
			ta'ampok	
			ta'kiltom	
			ta'mangsang	
			manai	Recently introduced; only stalks are eaten
ta'matchi ta'jong	yam	*Dioscorea* sp.		
narikep karek nakap	bean	*Phoselus* sp.		
e'ching	ginger	*Zingiber officinale*		
heldi	turmeric	*Curcuma longa*		
sosra	sponge gourd	*Luffa cylindrica* Roem		
alakongsi	snake gourd	*Trichosanthes anguina*		
dorai	okra	*Hibiscus esculentus*		Grown for selling only
galawareng	bitter gourd	*Momordica charantia*		
kil	cotton	*Gossypium arboreum*		Used to be grown as a cash crop

TABLE 3. Crops Grown at Wajadagiri: Shifting Plots

LOCAL NAME	ENGLISH NAME	BOTANICAL NAME	VARIETIES (E = EARLY)	REMARKS
mi	paddy	*Oryza sativa*	mikidep	
			mimagisim	
			ronggitchon (manggni) (E)	
			ronggitchon (padrap)	
			ronggitchon (sangrema)	
			chualjo	
			chualjo (rongdal-gipa) (E)	
			mimitim (doka)	Used for special preparations and
			mimitim (dokru)	for preparing beer only
			michibol	Used for special preparations and for preparing beer only

Continued

TABLE 3.—*Continued*

LOCAL NAME	ENGLISH NAME	BOTANICAL NAME	VARIETIES (E = EARLY)	REMARKS
misi	finger millet	*Eleusine corakana*	sarang (E)	Used for preparation of beer only
			sarangagatchi (E)	
			bilni	Preferred for making beer
			jongni (gisim)	Preferred for making beer
			jongni (gipbok)	Preferred for making beer
			agra	Exclusively used for making beer
			ato	Preferred for brewing
kil	cotton	*Gossypium arboreum*		A cash crop
mekop	maize	*Zea mays*	rengsi	Used for popcorn
			akinte or jonggiting (E)	
			wasok	
baring	brinjal	*Solanam* sp.		
jallik	chilli	*Capsicum annum*		
akaru-kobok	white gourd	*Benincasa cerifera*		
gominda	red gourd	*Cucurbita maxima*		
ta'a	arum	*Colocasia antiguorum*	ta'ma	
			ta'ring	
			ringdubi	
			ta'mitim	
			ta'ma-singkam	

TABLE 4. CROPS GROWN AT WAJADAGIRI: PERMANENT PLOTS

LOCAL NAME, (ENGLISH NAME), BOTANICAL NAME	VARIETIES	WET OR DRY	METHOD OF PLANTING	REMARKS
mi (paddy) *Oryza sativa*	asu gipbok	Dry	Usually broadcast, occasionally transplanted	
	mibanggal	Dry	Usually broadcast	
	kainal	Dry	Usually broadcast	
	sil-katuri or kochuamon	Wet	Transplanted	
	mairanga	Wet	Transplanted	
	heldiram	Wet	Transplanted	
	jaha	Wet	Transplanted	Fine rice grown for selling only
	bok	Wet	Transplanted	Fine rice grown for selling only
	mimitim gipbok or bija minel	Wet	Transplanted	Not used for principal meals.
	mimitim gitchak	Wet	Transplanted	Preferred for brewing
kosta (jute) *Olitonius capsularies*		Dry	Broadcast	

TABLE 5. CROP PRODUCTION: MATCHAKHOLGIRI AND WAJADAGIRI (IN MAUNDS)

	MATCHAKHOLGIRI					WAJADAGIRI				
				AVERAGE					AVERAGE	
CROP	1963	1964	1965	PER HHLD*	PER ACRE	1963	1964	1965	PER HHLD*	PER ACRE
Shifting plots										
Cotton	8.50	6.00	0.50	0.33	0.13	30.00	27.12	35.50	1.36	0.30
Paddy	632.00	526.50	507.75	37.02	14.80	20.00	25.12	18.12	1.11	0.24
Millet	123.00	91.00	26.00	5.33	2.10	21.00	18.60	16.60	0.79	0.18
Deccan hemp	8.50	3.00	1.37	4.25	1.70	–	–	–	–	–
Permanent plots										
Wet paddy						1014.50	910.50	962.50	41.85	
Dry paddy						182.00	152.00	140.00	6.87	
Jute						28.50	22.25	25.00	1.09	

SOURCE: Majumdar 1978. One maund ≅ 37.324 kg.

* Average production divided by total number of households in village, for shifting plots. For permanent plots, average total production for three years divided by total number of households.

TABLE 6. TIME SCHEDULE FOR WEEDING AND HARVESTING CROPS FROM SHIFTING CULTIVATION

CROPS	MONTH OF SOWING	MONTH OF HARVESTING	WEEDING PERIOD[a] AND APPROX. HOURS	REMARKS
Millet (E) Millet (L) Paddy (L) Melon/gourd/ other vegetable	March	August September	March 707 hr	Taking 9 hours per day, less 2 hours (approx.) leisure period a day. The initial 3 months experience heavy rainfall (see Table 1), and weeds grow rapidly, hence the involvement of tools becomes greater.[b]
Bringil/ chilli Paddy		October	August	Taking 6–7 hours a day, leisure period as above.
Manioc/yams Deccan hemp			160 hr	
Ginger/arum Beans Sesame and similar seeds		November	September 120 hr October 100 hr	Working hours decline steadily through October–November
Cotton Lae		December January	November (exact hours not known)	
Paddy (L) (changing)				

SOURCES: Majumdar 1978; Playfair 1975; Borah and Goswami 1977; personal observations.

NOTES: a. Weeding starts 20–25 days after sowing.

b. The main tool used is the hoe. The *dao* is not uncommon, but its use is extremely limited. The area covered by each person is approximately 0.55 acre per day, but cannot be ascertained exactly since one individual will use his own hoe to help another during the peak period. The period and location of the hoe blade's use are therefore not restricted to one individual's area.

E = early; L = late

Hoe (*gitchi*, Fig. 1)

The hoe consists of two parts—blade and shaft. The blade is made of iron, and its length, breadth, and thickness are 20.0 to 23 cm, 6.0 to 7.5 cm, and 0.2 to 0.4 cm, respectively. The shaft is made of bamboo having internodes at short intervals. Where the blade is inserted, the diameter of the shaft varies from 5 to 7 cm, and its length varies from 44 to 48 cm. The compact and slightly bent portion of the stump is selected for insertion of the blade. The shaft and the blade form an angle varying from 40° to 50°. This tool is exclusively for weeding, and is used primarily by females.

Digging stick (*matea*, Fig. 2, Pl. I)

This is used solely for sowing, and measures approximately 100 to 125 cm in length and 5 cm in diameter. It is very simple in construction: both ends are pointed and sometimes they are hardened by charring in a fire. The ends are kept pointed by frequent rubbing against exposed rocks when they become blunt from use.

Choppers

The choppers used by the traditional Garo consist of two types:

Ate (Fig. 3*a*)

This is made with an iron blade and a shaft of bamboo. The pointed tang of the blade is inserted into the compact end of the bamboo. It has emerged as a multipurpose implement used for felling brush, and lopping the branches of trees, and occasionally for weeding. The outline of the working edge of the blade is concave-convex.

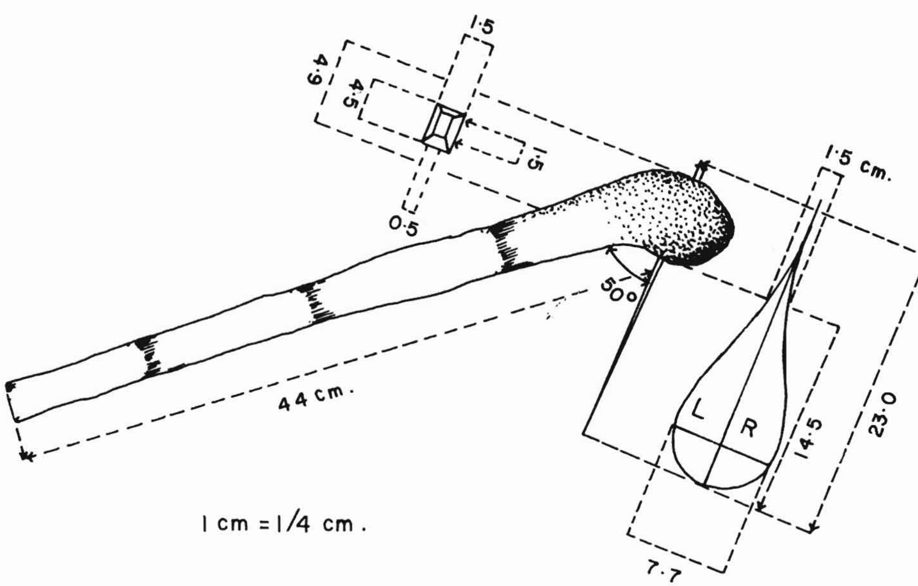


Fig. 1 Construction pattern of Garo hoe (iron blade).

Plate I *Jhum* field.

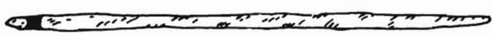


Fig. 2 Digging stick.

Ate mongren (Fig. 3*b*)

A heavy duty tool with a function similar to that of *dao* and *rua* (axe). It is more an axe than a *dao,* and is used for slashing bamboo and lopping the branches of trees. It is heavy and its working edges correspond to those of the *dao.*

Axe (*rua;* Fig. 3*c*)

In traditional eastern Garo villages this differs considerably from the *rua* found in the central part of the Garo Hills. In the eastern part it is a carpentry tool, elongated in size and shape; the pointed part is inserted into the wooden shaft and the blade remains slightly inclined toward the shaft (Fig. 4). *Rua* are of different types; each of which necessarily subserves the need of carpentry (Roy 1980). In the central Garo Hills *rua* stands for the socketed axe of the plain (Fig. 3*c*). Stone axes that correspond to the *rua* of the eastern part of the Garo Hills are also reported from the central part.

Edge-Wear Pattern of the Iron Hoe

To understand the edge-wear pattern of the iron hoe used in *jhum* cultivation, it is important to consider the situation of its use, that is, the angle of inclination of the surface

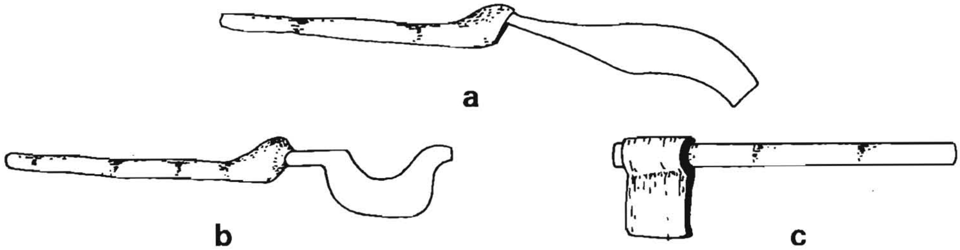


Fig. 3 *a*, ate; *b*, ate mongren; *c*, axe.

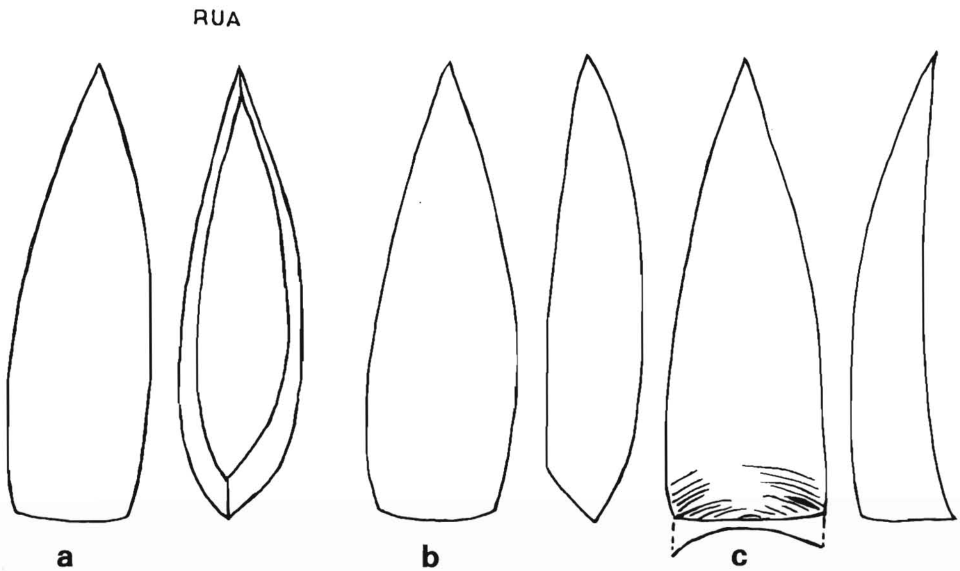


Fig. 4 *a*, adze, length 10.0–12.0 cm, breadth 3.4–4.0 cm, thickness 1.5–2.5 cm. *b*, axe, length 10.0–12.0 cm, breadth 3.4–4.0 cm, thickness 1.5–2.5 cm. *c*, adze type, length 10.0–12.0 cm, breadth 3.0–4.0 cm, thickness 1.5–2.5 cm.

where the cultivation is practiced (Fig. 5). This involves the angle of the hoe (blade and shaft), the angle of inclination of the surface of the field, and the flexion of the body of the worker (Figs. 1, 5).

The hoe is employed with a forward arching movement and loose soil is moved back toward the operator. The movement of the operator is always forward, from worked up to unworked soil. Her body remains more or less parallel to the surface (Pl. II; Fig. 5). While working, she cannot draw the hoe backward in a straight movement; for a right-handed woman the blade becomes slightly angled toward the right and is drawn in the same direction, causing the blade to become worn to a greater extent on its right side than its left (Fig. 6). In this manner the right side of the blade becomes unsuitable for work, a condition that is very often compensated for by turning the blade upside down in the shaft to use the other side. Sometimes the two sides are used by rotating the grip.

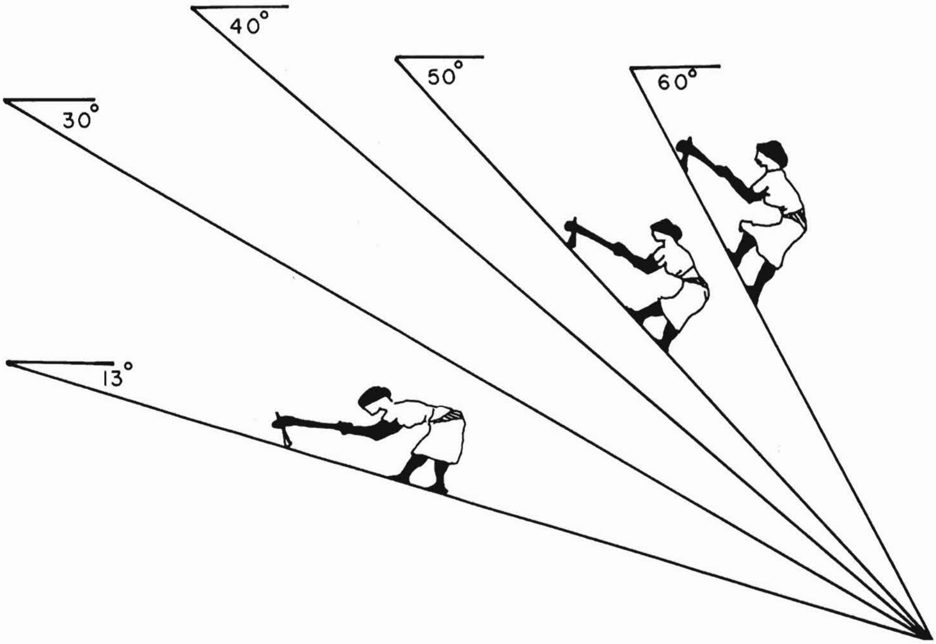


Fig. 5 Relationships of inclination of surface, hoe, and body flexibility.

Plate II Weeding.

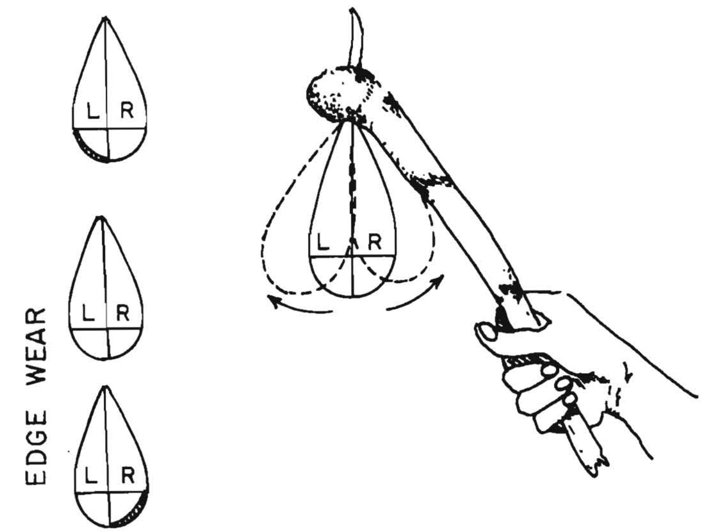


Fig. 6 Manipulation of hoe and nature of edge wear (iron).

TABLE 7. FREQUENCY AND PERCENTAGE OF IRON HOE BLADES BY SIZE CLASSES (N = 49) (SEE FIG. 6)

LENGTH (CM)	FREQUENCY	PERCENTAGE	BREADTH (CM)	FREQUENCY	PERCENTAGE
10 - 11	5	10.20	3.7 - 4.2	11	22.44
12 - 13	4	8.16	4.3 - 4.8	0	-
14 - 15	16	32.65	4.9 - 5.4	10	20.40
16 - 17	17	34.69	5.5 - 6.0	8	16.32
18 - 19	3	6.12	6.1 - 6.6	14	28.57
20 - 21	1	2.04	6.7 - 7.2	4	8.16
22 - 23	3	6.12	7.3 - 7.8	0	-
			7.9 - 8.4	1	2.04
			8.5 - 9.0	1	2.04

One cannot use the blade for an indefinite period; after wearing down to a particular length a blade ceases to work effectively and is ultimately discarded. Table 7 and Figure 7 give some idea about the extent of the edge wearing with reference to its effectiveness, and in Table 8 these measurements are given for specific periods of use. This is determined by comparison with an unused hoe blade (length 23 to 26 cm), which may be taken for standard size.

It is questionable whether an iron hoe blade is superior to a stone blade, but it would appear that the iron hoe is better than the stone one. Whether this difference affects productivity will be returned to later.

TOOLS FROM THE NEOLITHIC SITE, RENGIGIRI

Data from the site consist of ground and chipped celts. The chipped celts are excluded from the present study. A careful examination of them suggests that they represent a stage

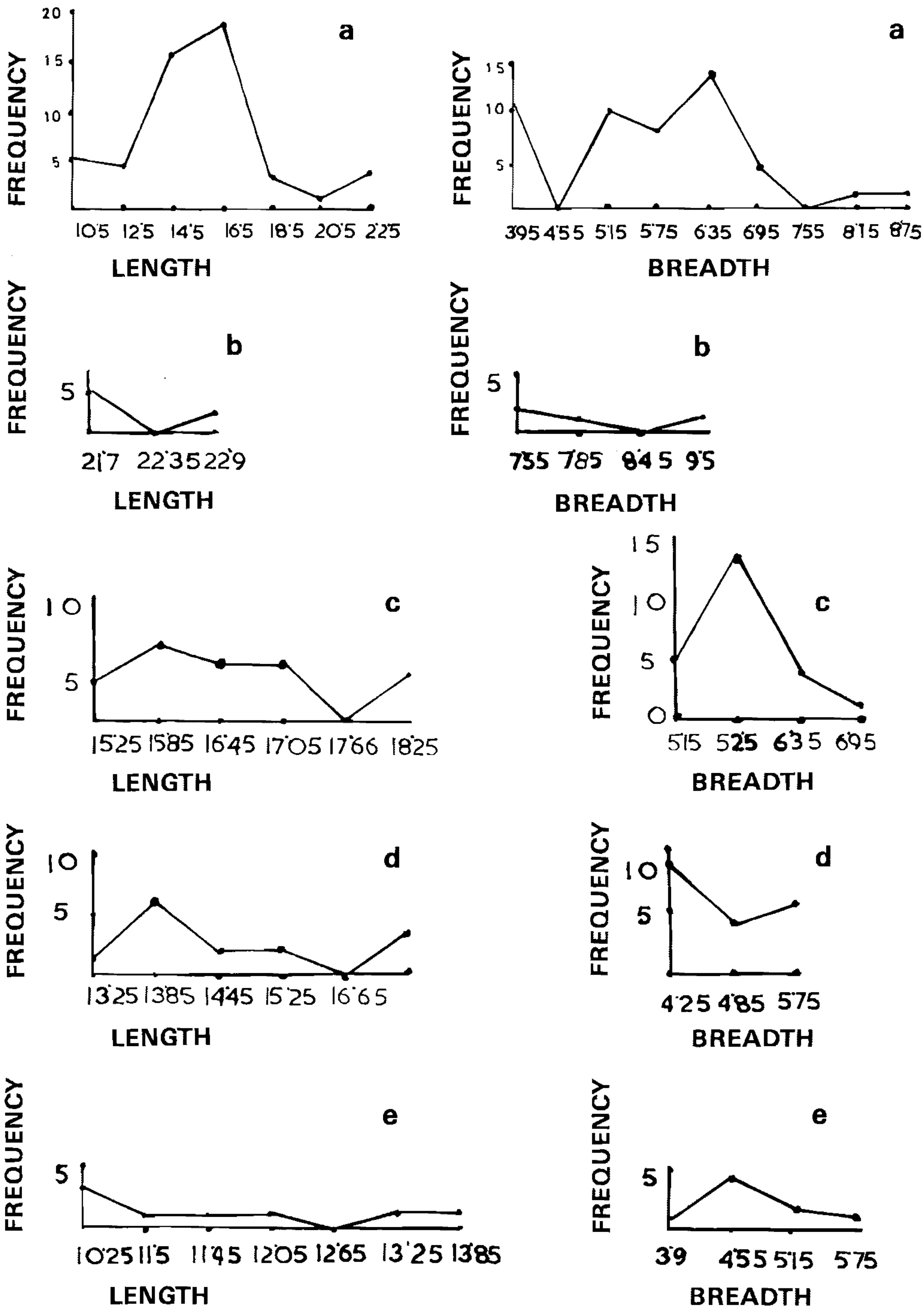


Fig. 7 Measurements of iron hoe blades currently used in the Garo Hills: *a*, for all measured blades; *b*, for blades used up to one year; *c*, blades used two to three years; *d*, blades used four to five years; *e*, blades used six years and over.

TABLE 8. FREQUENCY AND PERCENTAGE OF IRON HOE BLADES BY SIZE CLASSES AND DURATION OF USE
(N = 49) (SEE FIG. 7)

LENGTH (CM)	FREQUENCY	PERCENTAGE	BREADTH (CM)	FREQUENCY	PERCENTAGE
0–1 year (1 × 1090 hours*) (N = 4)					
21.5–22.0	3	75.0	7.0–7.5	2	50.0
22.1–22.6	0	–	7.6–8.1	1	25.5
22.7–23.2	1	25.0	8.2–8.7	0	–
			8.8–9.3	1	25.5
2–3 years (2 × 1090 hours) (N = 23)					
15.0–15.5	3	13.04	4.9–5.4	5	21.73
15.6–16.1	6	26.08	5.5–6.0	13	56.52
16.2–16.7	5	21.73	6.1–6.6	4	17.39
16.8–17.3	5	21.73	6.7–7.2	1	4.34
17.4–17.9	0	–			
18.0–18.5	4	17.39			
4–5 years (3 × 1090 hours) (N = 14)					
13.0–13.5	1	7.14	4.0–4.5	8	57.14
13.6–14.1	6	42.82	4.6–5.1	4	28.57
14.2–14.7	2	14.28	5.5–6.0	2	14.28
14.8–15.3	2	14.28			
15.4–15.9	0	–			
16.0–16.5	3	21.42			
6 years + (4 × 1090 hours) (N = 8)					
10.0–10.5	3	37.5	3.7–4.2	1	12.5
10.6–11.1	1	12.5	4.3–4.8	4	50.0
11.2–11.7	1	12.5	4.9–5.4	2	25.0
11.8–12.3	1	12.5	5.5–6.0	1	12.5
12.4–12.9	0	–			
13.0–13.5	1	12.5			
13.6–14.1	1	12.5			

* Utility period of the blades in approximate number of hours.

prior to the production of ground or partially ground celts. Sharma (1966) considered the chipped celts to be a variety of neolithic celts. The chipped celts with which I am dealing here may be taken as "preform" (Bradley 1975:5–13), since none of them exhibit any edge-wear marks. In size and shape the chipped celts correspond to the ground unshouldered blades.

Tools recovered from the site may be divided into two broad groups: tools directly related to agricultural activity; and tools for carpentry. Tools from the second group are used mainly for dressing and preparing the shafts for the insertion of stone adze (hoe) and axe blades. In addition, tools may have some secondary functions.

The tools directly related to agricultural activity consisted of 14 unshouldered and 13 shouldered axes; and two types of hoe blades: 163 blades without tenon or shouldering; and 139 blades with tenon or shoulder. The tools for carpentry were 7 adzes and 3 chisels. There were 66 chipped celts (preform).

Axe and hoe blades often cannot be differentiated from one another, since, typologically, they exhibit several common characteristics. The difference between the two becomes explicit when their functional and metric characteristics are considered. For interpreting the problem, only agricultural tools were studied, leaving the other two groups for later study.

Hoe Blade Measurements

Determination of the standard size and shape of the new neolithic hoe blade remains a problem, which a comparative study of the iron and stone blades from this area should help to clarify. When used, a blade is gradually reduced in length and breadth. This reduction in size continues until it is no longer suitable for its function, at which time it is generally discarded. This being the case, most of the hoes that we recovered had reached the point where they were no longer of use. From this we can say only that the ideal and useful size of the stone hoe blades was larger than the recovered tools. With that we look at the measurements.

The length, breadth, and thickness of the hoes (Fig. 8) are presented in graph form in Figures 9 to 11 and their percentages by size classes in Table 9 and 10. The most frequent length of the unshouldered hoes (Plate III*b*) is from 7.0 to 7.4 cm, and for the shouldered hoes (Plate III*a*) is 6.0 to 6.4 cm. The breadth is from 5.0 to 5.4 cm and 6.0 to 6.4 cm, respectively, and the thickness from 1.4 to 1.5 cm for both types. Presumably the thickness would change relatively little with use before the tool was discarded. While the thicknesses of the shouldered and unshouldered blades are very similar, there is an obvious dif-

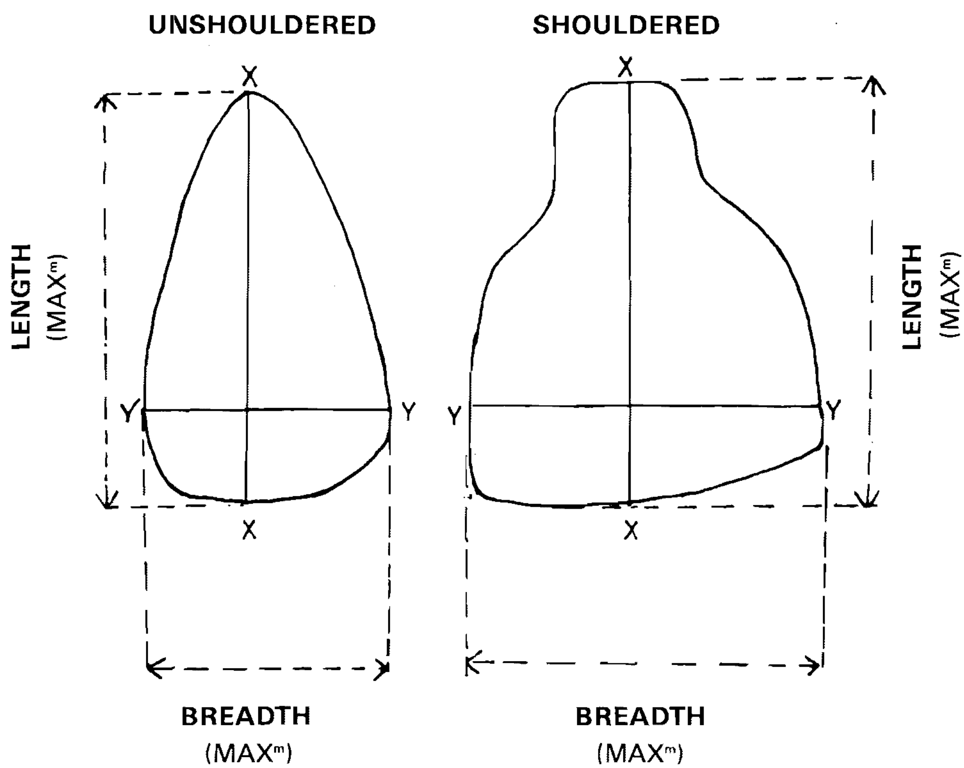


Fig. 8 . Dimensions of unshouldered and shouldered hoes (measurements taken with sliding caliper).

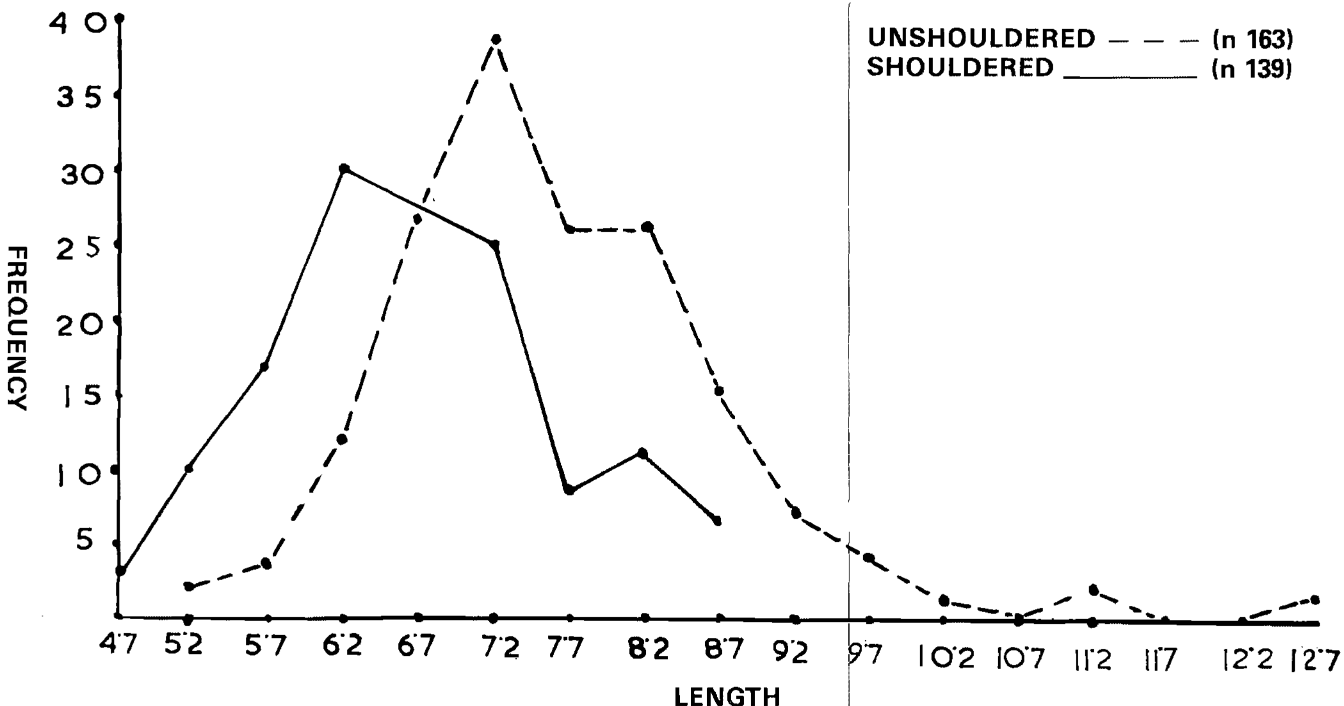


Fig. 9 Frequencies of lengths of unshouldered and shouldered hoes.

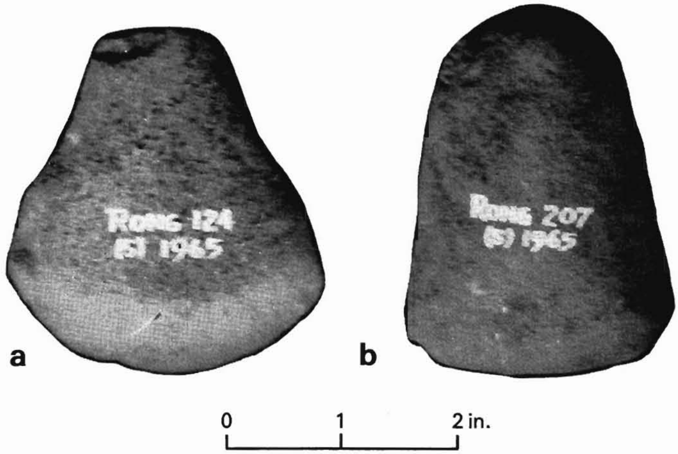


Plate III *a*, shouldered and *b*, unshouldered stone hoes from the Garo Hills, Meghalaya.

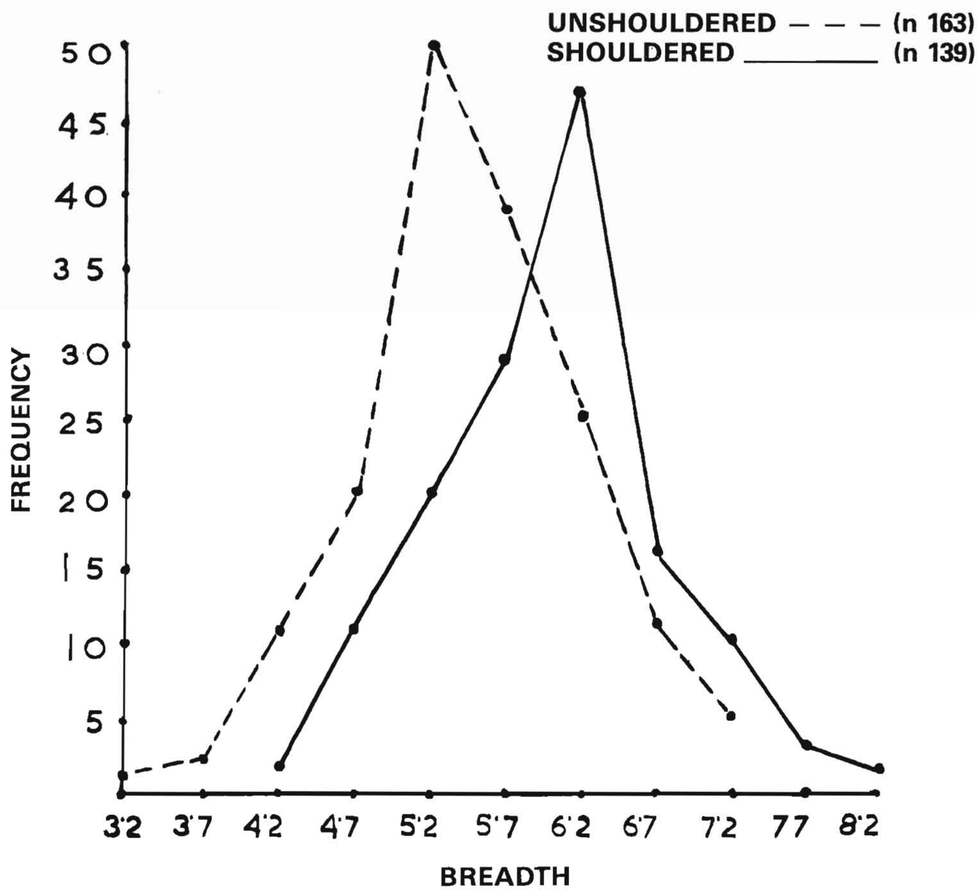


Fig. 10 Frequencies of breadths of unshouldered and shouldered hoes.

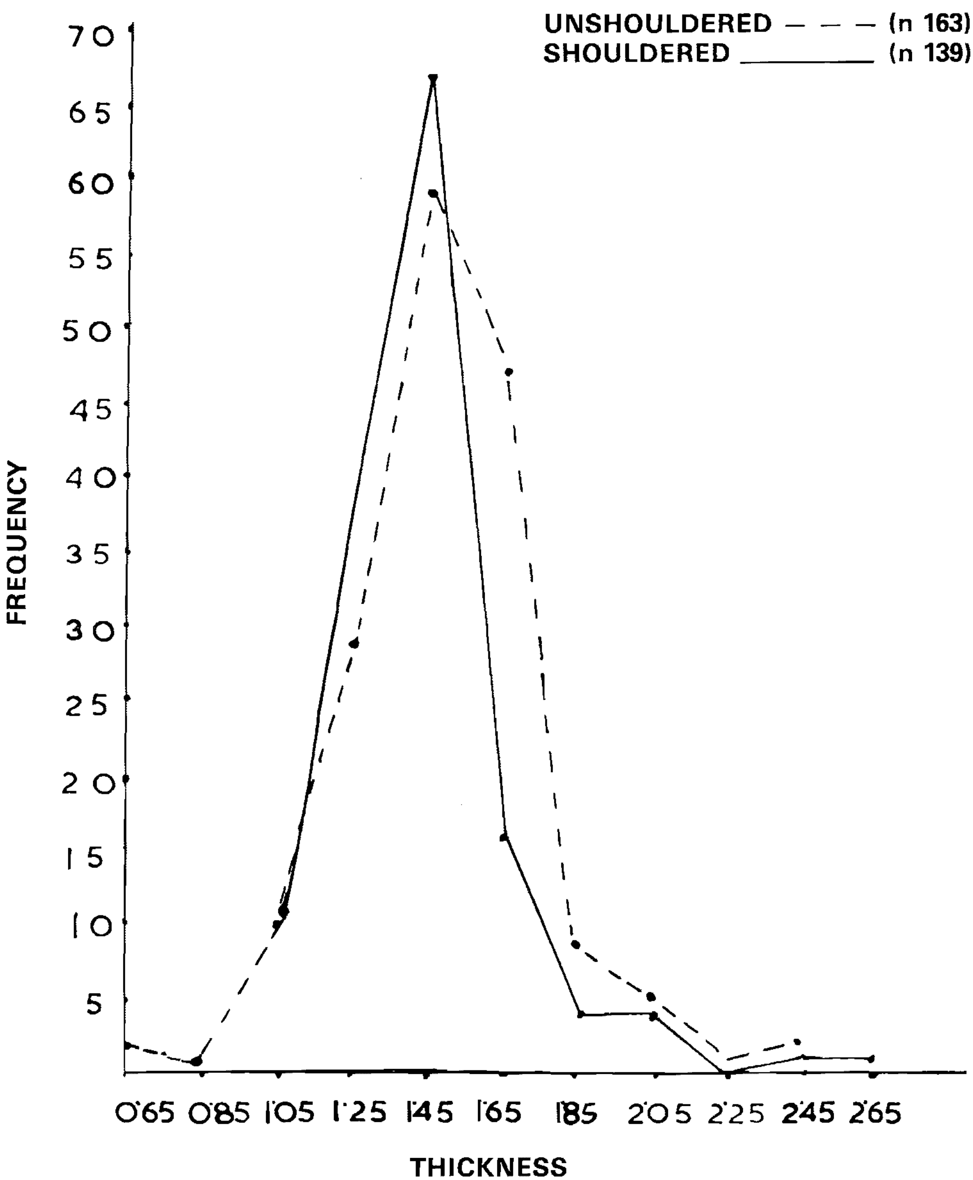


Fig. 11 Frequencies of thicknesses of unshouldered and shouldered hoes.

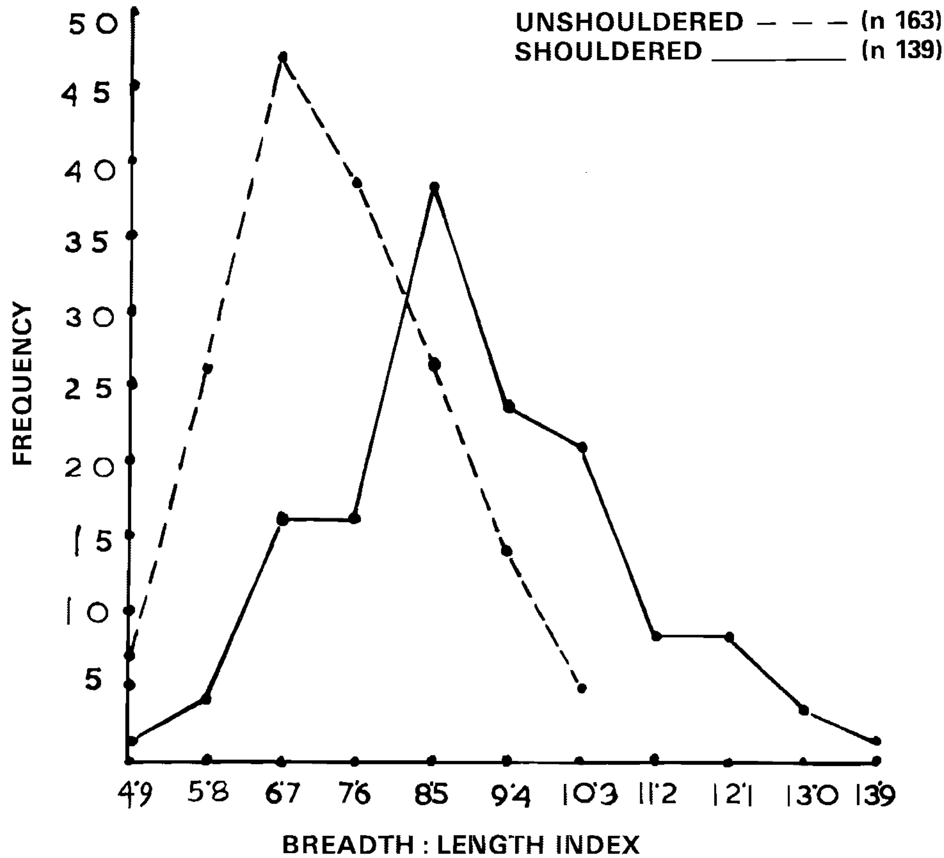


Fig. 12 Frequencies of breadth : length ratios, unshouldered and shouldered hoes.

ference in the length and breadth, with the unshouldered blades about 1 cm longer and 1 cm narrower than the shouldered ones. This shows clearly in the breadth : length ratios of the two, where the ratio is considerably higher for the shouldered blades than for the unshouldered (Tables 11, 12; Fig. 12).

Edge Wear

Tools, and hoe blades in particular, were discarded when they ceased to serve their primary function. The length of time such tools can be used is determined by a number of limiting factors, including the reduction in their length as a result of use; the thickness of the blade and its optimum length for a particular task; and the hardness and durability of the stone. These three factors are interlinked. Above all, the life span of the hoe blade is determined by the frequency of use.

A study of the wear pattern (Figs. 13, 14) of these tools reveals certain interesting features if the blade is divided longitudinally into two halves.

Most of the hoe blades become worn to a greater extent on one side only (Table 13),

TABLE 9. FREQUENCY AND PERCENTAGE OF UNSHOULDERED STONE HOE BLADES BY SIZE CLASSES (SEE FIGS. 9, 10, 11) (N = 163) (CM)

LENGTH (FIG. 9)	FREQUENCY	PERCENTAGE	BREADTH (FIG. 10)	FREQUENCY	PERCENTAGE	THICKNESS (FIG. 11)	FREQUENCY	PERCENTAGE
5.0–5.4	2	1.23	3.0–3.4	1	0.61	0.6–0.7	2	1.23
5.5–5.9	3	1.84	3.5–3.9	2	1.23	0.8–0.9	1	0.61
6.0–6.4	12	7.36	4.0–4.4	11	6.75	1.0–1.1	10	6.13
6.5–6.9	26	15.95	4.5–4.9	20	12.27	1.2–1.3	28	17.18
7.0–7.4	38	23.31	5.0–5.4	50	30.67	1.4–1.5	59	36.20
7.5–7.9	26	15.95	5.5–5.9	38	23.31	1.6–1.7	47	28.83
8.0–8.4	26	15.95	6.0–6.4	25	15.34	1.8–1.9	8	4.91
8.5–8.9	15	9.20	6.5–6.9	11	6.75	2.0–2.1	5	3.07
9.0–9.4	7	4.29	7.0–7.4	5	3.07	2.2–2.3	1	0.61
9.5–9.9	4	2.45				2.4–2.5	2	1.23
10.0–10.4	1	0.61						
10.5–10.9	0	-						
11.0–11.4	2	1.23						
11.5–11.9	0	-						
12.0–12.4	0	-						
12.5–12.9	1	1.23						

TABLE 10. FREQUENCY AND PERCENTAGE OF SHOULDERED STONE HOE BLADES BY SIZE CLASSES (SEE FIGS. 9, 10, 11) (N = 139) (CM)

LENGTH (FIG. 9)	FREQUENCY	PERCENTAGE	BREADTH (FIG. 10)	FREQUENCY	PERCENTAGE	THICKNESS (FIG. 11)	FREQUENCY	PERCENTAGE
4.5–4.9	3	2.16	4.0–4.4	2	1.44	1.0–1.1	11	7.91
5.0–5.4	10	7.19	4.5–4.9	10	7.19	1.2–1.3	35	25.18
5.5–5.9	18	12.95	5.0–5.4	20	14.39	1.4–1.5	67	48.20
6.0–6.4	30	21.58	5.5–5.9	29	20.86	1.6–1.7	16	11.52
6.5–6.9	27	19.42	6.0–6.4	47	33.81	1.8–1.9	4	2.88
7.0–7.4	25	17.99	6.5–6.9	16	11.51	2.0–2.1	4	2.88
7.5–7.9	8	5.76	7.0–7.4	10	7.19	2.2–2.3	0	-
8.0–8.4	11	7.91	7.5–7.9	3	2.16	2.4–2.5	1	0.72
8.5–8.9	7	5.04	8.0–8.4	2	1.44	2.6–2.7	1	0.72

TABLE 11. PERCENTILE FREQUENCY OF BREADTH-LENGTH INDICES OF UNSHOULDERED STONE HOE BLADES (N = 163) (SEE FIG. 12)

BREADTH-LENGTH INDEX	FREQUENCY	PERCENTAGE
45–53	7	4.29
54–62	26	15.92
63–71	47	28.83
72–80	38	23.31
81–89	26	15.95
90–98	14	8.58
99–107	5	3.06

TABLE 12. PERCENTILE FREQUENCY OF BREADTH-LENGTH INDICES OF SHOULDERED STONE HOE BLADES (N = 139) (SEE FIG. 12)

LENGTH-BREADTH INDEX	FREQUENCY	PERCENTAGE
45–53	1	0.71
54–62	4	2.87
63–71	16	11.51
72–80	16	11.50
81–89	38	27.33
90–98	23	16.54
99–107	21	15.75
108–116	8	5.75
117–125	8	5.75
126–134	3	2.15
135–143	1	0.71

which is usually the right (86.42%) rather than the left side. This is the same for both groups (unshouldered 93.25%; shouldered 78.41%).

Furthermore, tools having single-side wear exhibit a unibevelled cutting edge (90%). Tools worn equally on both sides are insignificant in number (5.9%) and most of them are double bevelled on both edges. From this I infer that these blades were used both right side up and upside down, a feature common to the metallic blades. Edge wear of the right side indicates tools that were used by right-handed women (Table 13).

Hoe and Axe: Relative Duration of Use

The axe and *dao* are essentially primarily used for clearing the jungle, and their utility remains confined to the initial phase of this operation. Although the axe and *dao* are used for short periods compared with the hoe, the work done with them is much more strenuous. The wear and tear on the axe or *dao* can be expected to be higher than that on a hoe blade.

The iron hoe blades are made thin to reduce the weight and thus the energy required during many and long days of use in the field (i.e., weeding). The axe blade is made thicker and heavier than the hoe so that it will have more penetration into a denser medium. A casual observation in the marketplace reveals that hoe blades are sold in the

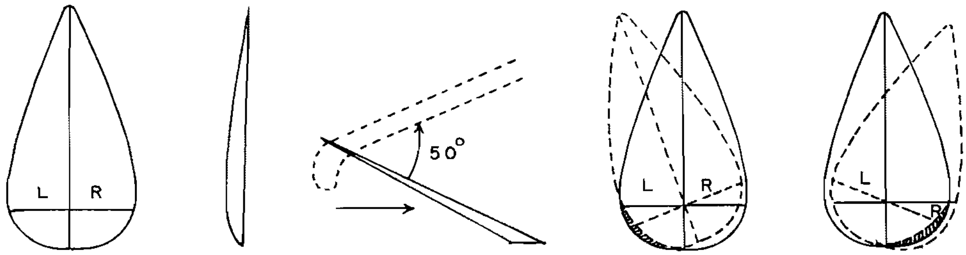


Fig. 13 Assumed manipulation and wear pattern of stone hoe blade.

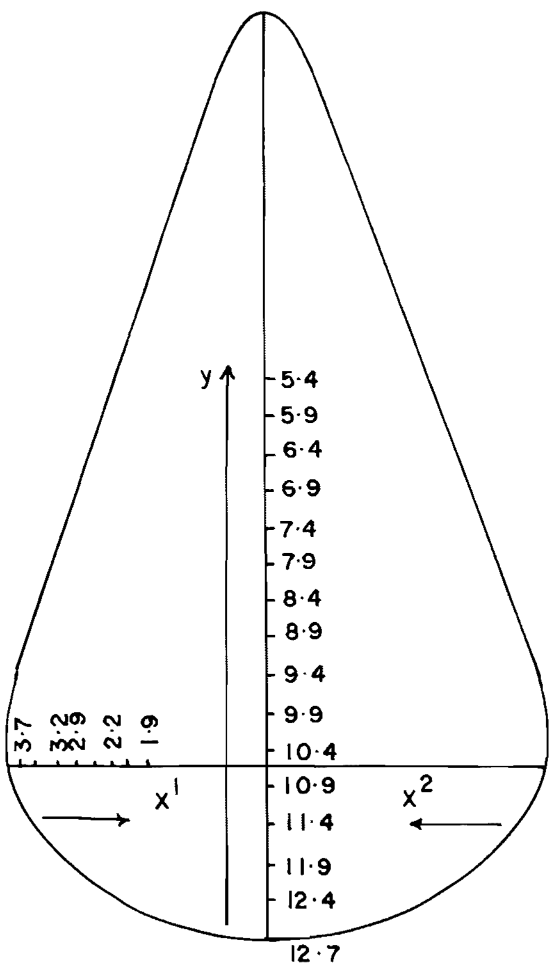


Fig. 14 Schematic diagram showing reduction in length and breadth of stone hoe blade. Breadth 1/2 X^1 + 1/2 $X^2 = X$.

TABLE 13. WEAR PATTERNS OF SHOULDERED AND UNSHOULDERED TOOLS

	SHOULDERED		UNSHOULDERED		TOTAL	
	NO.	%	NO.	%	NO.	%
Worn on both sides	15	10.79	2	1.22	17	5.62
Equal on both sides	13	9.35	5	3.06	18	5.90
Worn on right side	109	78.41	152	93.25	261	86.42
Worn on left side	2	1.4	4	2.44	6	1.65
Total	139		163		302	

weekly market ten times more often than axes or *dao*. Because the hoe blade is used for longer periods in *jhum* operation, its blade wears more rapidly than that of the axe with the result that many more hoe blades than axes are needed. While the wear of hoe blades and axes made of stone cannot be equated directly with that of blades and axes of iron, it does suggest that there would be a somewhat similar demand for replacement of the stone tools.

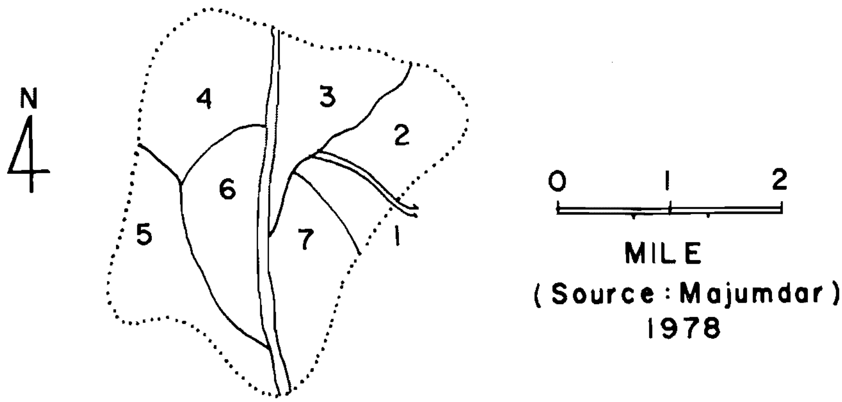
The main point I would like to make from the ethnographic situation is that for each variety of crop the required period from planting to harvest is set by nature. The maximum weeding period is for the rice and millet crops. The use of the hoe reduces gradually after the harvesting of these two crops. Over that, humans have no control. What is more important is that within a given period the weeding of each type of crop must be completed. Otherwise, there is the possibility of underproduction. To complete the weeding process within a given time, a woman might use five or more hoe blades made of stone in place of one hoe having an iron blade. Thus it may be argued that tool material does have an effect on the life span of the tools but it does not have a direct effect on the production of crops. To reach a target of crop production within a set period, a woman will work the given area of land with whatever number of tools is needed, irrespective of their material, as long as it is available.

JHUM CULTIVATION AND ITS CARRYING CAPACITY

Over the last several decades there has been a constant tendency to shorten the "*jhum* cycle." At Garo Hills, in the past the cycles were 20 to 30 years. The growth of population has reduced the cycles to 4 or 5 years, and in some areas, even less. Such a reduction in *jhum* cycles has in turn reduced the fertility of the land as well as the yield.

Saha (Borah and Goswami 1977:40), using the example of Aglagiri, estimated that with a minimum *jhum* cycle of 15 years the maximum density which can be supported with a minimum standard of living is only 5 persons per km^2. Figures from the other hilly areas of Assam do not vary much from this (Borah and Goswami 1977:12).

The range of population estimated at Darengiri and Matchakholgiri is 6 and 7 per km^2 respectively, with *jhum* cycles of 6 to 7 years. The principal crops from both villages (Tables 3 and 4), based solely on shifting cultivation, hardly produce a surplus. The economic condition of the families solely dependent on such cultivation is one of constant strain, whereas families pursuing both wet and shifting cultivation are better off. Matchakholgiri depends solely on shifting cultivation while Wajadagiri engages in both wet and shifting cultivation (Map 3). In respect to annual cash income, Matchakholgiri does



Map 3 Seven-year plot rotation at Matchakholgiri. Number, year of cultivation, and name of plot: 1 = 1959, Doldigiri songsam; 2 = 1960, Rongkon-bibra; 3 = 1961, Song-gitcham; 4 = 1962, Songsam; 5 = 1963, Magana; 6 = 1964, Bujel gitim; 7 = 1965, Doldigiri songsam.

better than Wajadagiri, but its production from *jhum* cultivation is not sufficient to sustain its population throughout the year. To compensate the inhabitants must depend on other means. The people of Matchakholgiri and Darengiri have become associated with their nearest urban center—Tura town. Tura, the main economic center of the Garo Hills, has absorbed the surplus male labor of these two villages, which becomes practically idle as soon as the first phase of shifting cultivation is over. In addition, cash crops are cultivated and sold in this urban center. This could not have been the situation in the past.

Economic sufficiency and monetary affluence are not always the same thing. Although the people of Matchakholgiri are economically better off they must work hard to meet the bare necessities of life. This is just the reverse for the people of Wajadagiri (Majumdar 1978:63–76).

To amplify this point, data from Annogiri collected nearly a decade ago by Majumdar (personal communication) may be used. Annogiri is a village remote from urban influence. Its economy was solely dependent on *jhum* cultivation with a cycle of 15 to 20 years and a population density between 5 and 6 persons per km^2. The *jhum* cultivation provided the minimum required for survival. No principal crop was traded out of the village except cotton.

There were no major economic differences among families such as were observed in Matchakholgiri and Wajadagiri. The bare necessities of life were met in Annogiri merely by widening the range of *jhum* cycles. There was little difference in the density of population in the three villages. Changes in location and reduction in the time range of *jhum* cycles did not bring about any major change in the carrying capacity of land.

Each household is economically self-contained and depends almost exclusively on its own labor resources. At times one person's labor has to be exchanged for another's, since each of the stages of *jhum* operation has to be completed within a stipulated time. A household may not have sufficient workers to cope with an urgent task within a short period. This situation is tackled by a traditionally evolved system of mutual labor exchange *(baragrika).* Weeding *(ajakhara, bimish)* and harvesting *(aka, oka)* operations impose such need for labor exchange. If the weeds are not cleared in time, rain may cause them to grow beyond control; likewise, the crops may be damaged by rains if not harvested in time. The burning of the *jhum* plots calls for coordinated action on the part of the villagers so that fire may be kept within the area of the current year's use and neighboring areas protected from fire hazard. Under this type of traditional system, a workload of several person-days can be completed by one household in a day by engaging labor of other households—with an obligation for equivalent return on succeeding days (Kar 1979).

CONCLUSION

A comparative study of the agricultural implements from the neolithic and the ethnographic contexts reveals a homogeneity in function. The constraints that the traditional peoples of this area face today were more or less the same for the neolithic peoples as well.

An economy based on hoe and axe has some adoptive characteristics that the complex economy and technological system lack. "Reciprocity and cooperation" is one of the major features exhibited by this traditional society. A household, though economically self-contained, cannot stand in isolation without the cooperation of others, because under the traditional system, the *adak* is not an individual's property for an indefinite period.

Here the economic force that binds the families together is egalitarian in character. In a mechanized socioeconomic system it is quite different, because families having heterogeneous economic compositions are held together by interdependent forces. However, there is evidence enough to show that heterogeneity existed in the neolithic period as well. This was shown by Renfrew (1969) while discussing the trade in neolithic economy of Europe. But in the Garo Hills, one finds a different picture. Here, the tools were made out of locally available materials (confirmed by the petrological study carried out on some of the specimens). In addition, the absence of a "centralized" political organization (Solheim 1972) stood in the way of development such as was outlined by Renfrew for the European context.

Specialization in tool types does not always mean occupational specialization. The ethnographic data from Garo Hills shows that even after the development of center-based socioeconomic organization there was no development of group specialization. The chances of specialization are minimized because of direct use of some of the naturally available materials (such as the use of naturally available bamboo tubes, leaves, and others), and by raising some horticultural items (i.e., gourd) not meant for food but as a vessel for carrying and storing water. In other parts of Northeast India (Roy 1977:129–138) and Southeast Asia, both neolithic and existing ethnographic cultures show a low level of techno-economic development, coupled with a close relationship between nature and culture.

The genesis of this economic character may be understood from the interplay of environment and technology. A family in relation to the whole socioeconomic system may be taken as an independent and self-contained economic unit, but in isolation it has no economic existence. Economically, all are almost equal and part and parcel of the whole socioeconomic system. This has caused the wealth to be distributed more or less equally among all the members of a clan. A *nokma* or chieftain is given some political power, but that political power is hedged by the decentralized socioeconomic structure.

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